

crust, and the changes which take place in it : in physical geography, however, the facts of physical science are made subservient to the descriptions of land forms and other matters directly connected with the study of the earth. In the present volume, for instance, "the non-geographical elements of astronomy, the principles of physics, and the divisions of geological time, are carefully excluded." The authors are, of course, entirely justified in limiting the sections dealing with these subjects to any dimensions they please ; and many teachers of physical geography will agree that the method of treatment adopted distinctly defines the scope of physical geography. At the same time, the opinion of the writer is that it is impossible for a student to clearly perceive many of the facts of physical geography unless he has a practical acquaintance with physical science. A student with a knowledge of Boyle's law can fully understand why half the earth's atmosphere is left behind in ascending to a height of three and a half miles above sea-level ; but a student of physical geography may be told that this is the case, and have no real conception of the cause. Almost every fact concerning the constitution and movements of the atmosphere can be far more easily comprehended by students who have received experimental instruction in the principles of physics than by those who read them for the first time in connection with natural phenomena. Similar introductory knowledge is also required to intelligently follow the action of internal forces such as give rise to volcanic eruptions, the system of oceanic movements, the solvent and disintegrating actions of water, causes which affect climate, and many other natural operations and conditions. A practical knowledge of the principles of the science of matter and energy is indeed essential to the scientific study of the earth ; and without such knowledge students of physical geography can have only a limited comprehension of the causes of natural processes.

As bearing upon this point, mention may appropriately be made of a new syllabus of physical geography which has just been prepared for the Cambridge Local Examinations. The syllabus includes a course of practical instruction drawn up with the distinct object of cultivating the pupils' faculties of observation and reasoning ; it therefore represents a praiseworthy attempt to make lessons in physical geography of real educational value. So far as the descriptive part is concerned, the volume under notice is exactly the kind of book to use in classes which follow the Cambridge course, and the appendices will be found of service in showing the observations which may be usefully made out of doors. But the sections on the atmosphere and on astronomical geography are too brief to be clearly comprehended by students unfamiliar with the rudiments of physics and astronomy. In the Cambridge syllabus experimental work in each of these divisions of physical geography is rightly given prominence ; and we consider that a larger amount of space might have been devoted to them with advantage in the present volume. As these sections now stand they will convey information, but will not do much to encourage individual observation. Moreover, most teachers will find it necessary to postpone the descriptions of atmospheric circulation to a later stage than is suggested by

the place in which it is here dealt with ; for though the volume contains a most admirable account of wind systems, every teacher knows that charts of winds and isotherms are not easily visualised by the student who has not learned to read such diagrams.

Apart from the question of the relative importance which should be attached to the different divisions of physical geography, it would be difficult to suggest how the volume could be improved. No better description of the lithosphere, and the changes which take place in it, could be desired by the student of physical geography than is given by the authors. The examples of characteristic land forms are naturally more often American than European or British ; but as emphasis is always laid upon the association of land forms with settlements and industries, a useful lesson is conveyed even if the selected district is strange to the reader. Several words, such as *monadnock*, *cuesta*, *drumlin*, *peneplain*, *esker*, and *mesa*, not usually found in books of physical geography used in this country, are employed to describe particular formations, though no explanation appears to be given of more common terms in physical geography, such as *hydrosphere*, *lithosphere*, *erratic*, *volcanic dyke*, *geoid*, *Roches moutonnées*, *scoriae*, *tundra*, *selvas*, *pampas*, and *regelation*—or if they are mentioned they are not indexed. Little importance need be attached to this, for physical geography should be more than a collection of definitions ; but as the student will in all probability meet with the words later, he should know their significance. This is, however, but a minor point, for a good dictionary will furnish the meanings of these words, but it is only occasionally that a volume of such an inspiring character as the one here noticed is produced, and where so many good qualities are exhibited, a judicious critic hesitates to suggest any alterations.

R. A. G.

THE REMINISCENCES OF A. D. BARTLETT.

Bartlett's Life among Wild Beasts in the "Zoo." By the late A. D. Bartlett. Edited by E. Bartlett. Pp. xviii + 375. (London : Chapman and Hall, Ltd., 1900.)

THE issue of the present volume may be taken as an indication that its predecessor, "Wild Animals in Captivity," was a success and has met with the appreciation of the public. Obviously, therefore, it is not the part of a critic to decry what has practically been already approved, the work before us being a continuation of the first series of *Reminiscences*. Undoubtedly there is a very large amount of extremely entertaining matter in this second venture. Especially is this the case with regard to the author's experiences of Gorillas and Chimpanzees, his important practical experiments and observations with regard to hybrids, his account of the verification of the hunters' stories as to the annual shedding of its horns by the American Prongbuck, and his description of the habits of the Indian Panda, or Cat-bear. The latter observations afford, indeed, an excellent example of the acuteness of Bartlett's judgment as to the affinity of an animal by the study of its habits alone. The systematic position of the Panda was at the time in question much disputed. Mr. Bartlett insisted on its

near relationship to the Racoons, especially the Kin-kajou; and his opinions were more than borne out by the contemporary investigations of Sir W. H. Flower into its internal anatomy. The public, too, will be much interested to learn that Bartlett was a firm believer in the existence of a "sea-serpent," although whether they will be inclined to share his opinion that there are reptiles that can live for months at a time at the bottom of the ocean without coming up to breathe may be questioned.

But much as these and many other portions of the book may interest and attract the general reader (not to mention the scientific naturalist), there are other parts for which such commendation can scarcely be claimed. We have, for instance, several descriptions of species, such as that of the white-whiskered Lemur (*L. leucomystax*) on p. 22, and Monteiro's Galago (*G. monteiroi*) on p. 24, which can be of no possible interest to any one but a specialist, especially in the absence of figures. But this is not all, as the aforesaid Lemur is now regarded by qualified naturalists merely as the female of (*L. macaco*), and its retention as a species is consequently a mere misleading of the public.

If this were the sole instance of a want of efficient editorship it might, indeed, well have been passed over in silence, but unfortunately it is only one among many. For instance, on the very first page of the volume we have a repetition of the old story that the Apes seen by Hanno, the Carthaginian, were Gorillas (in the modern sense of that term), whereas it has been shown over and over again that such could not have been the case; Mr. Winwood Reade believing the creatures to have been Baboons, while Sir Harry Johnstone thinks they were more probably Chimpanzees. Neither is it a true statement that the skull of the Gorilla obtained by Dr. Savage at the Gaboon was ever sent to Owen, who only received sketches of the same; the specimen itself having apparently gone to America. It is quite true that these statements were made by the author of the papers which constitute this volume, but it was for the editor to have made the necessary amendments.

Then, again, we have to deplore a lack of efficient editorship in the manner in which the different sections of the book are introduced, or rather not introduced. For example, who would guess that the dissertation on hybrid bovine animals, commencing on p. 71, is reproduced, with the exception of the opening sentence, word for word from the *Proceedings* of the Zoological Society for 1884? And if the quotation is not acknowledged as such by the usual marks in this place, why are such marks introduced in another equally long quotation from the same serial on p. 6? Neither is there any indication to show that the portrait of the Chimpanzee "Sally" on p. 7, as well as the picture of hybrid Cattle on p. 70, are copied from plates in the Zoological Society's *Proceedings*. And very indifferent copies at that, the reader will probably add! Indeed, the illustrations generally are far from being a strong point of the book, while, like the regiments in the British army, there are too few of them.

Neither can we avoid saying that the nomenclature is hopelessly out of date; this being sufficiently apparent

when we mention that *Trogodytes* is given as the generic name of the Chimpanzee and Gorilla, *Ceriornis* for the Tragopan, and *Felis* for the Hunting Leopard or Chita! If popular writers will not keep somewhat in touch with the systematic work of the day, it is their fault if they are treated with contempt by professional naturalists.

In spite of the errors and imperfections to which we have called attention, we, as already said, fully recognise the large amount of interesting matter in the volume before us; and if our readers desire a really amusing story, we may refer them to the adventure of Mr. and Mrs. Jamrach with the Lions. At the same time, we think that the editor would have been much better advised had he reduced the present volume and its companion to the limits now occupied by one of them.

R. L.

ELECTRICAL OSCILLATIONS.

Recherches Expérimentales sur les Oscillations Électriques. Par A. Turpain. Pp. 154. (Paris: Librairie Scientifique, A. Hermann, 1899.)

THE classical researches of Hertz on electromagnetic waves have opened up a new field of experimental research, which has already yielded a rich harvest of results. As regards the literature of the subject, we have, besides Hertz's original papers, two or three other works dealing with the theory and phenomena of electromagnetic waves. Dr. Lodge's little book contains a general and easily intelligible sketch of the whole subject. In Prof. J. J. Thomson's "Recent Researches" we have an elaborate exposition of theory, along with an account of the experimental development of the subject down to the date of publication. Poincaré's "Oscillations Électriques" is probably the best-known Continental work on electromagnetic waves.

The work before us is one which does not trench on the ground already covered by the above-named treatises. It is a record of original researches, some of which have already appeared in various scientific periodicals. The scope of these researches is limited to the propagation of waves along conductors.

After a brief introduction, the author gives us in Chapter i. a full and clearly illustrated description of the experimental arrangements used by him, including the various forms of oscillators, resonators and their micrometers, and methods of concentrating the electromagnetic field between wires or plates.

Chapter ii. deals with the methods of measurement. Besides the classical method of determining the sparking distance by means of a micrometer observed either with the naked eye or by the aid of a lens, the author used a resonator with an additional air-gap which was bridged by a battery and telephone receiver. Every time sparks passed across the micrometer-gap, the circuit of the battery and telephone was completed. This method of investigation—which, however, requires very careful adjustment—the author found less fatiguing than that in which the eye is unduly strained in trying to detect the presence of minute sparks.

Chapter iii. describes the methods adopted for adjusting the length of the wires so as to get a sharp division into nodal and ventral segments. This is followed by an